Technical Support Document for Louisiana Regional Haze: CALPUFF Best Available Retrofit Technology Modeling Review

(CALPUFF Modeling TSD)

Prepared by:

Michael Feldman
Erik Snyder

April 2017
(revised May 2017 and June 2017 to include Entergy Nelson)

Table of Contents

Tables

I. Introduction

To address the first implementation period, the State of Louisiana submitted a RH SIP on June 13, 2008 (hereafter referred to as the 2008 Louisiana Regional Haze SIP). EPA acted on that submittal in two separate actions: a limited disapproval (77 FR 33642; June 7, 2012) because the SIP relied on the Clean Air Interstate Rule (CAIR) to address the impact of emissions from the State's electric generating units (EGUs); and a partial limited approval/partial disapproval (77 FR 39425; July 3, 2012) noting deficiencies in the SIP revision that did not meet the applicable requirements of the CAA and EPA's regulations as set forth in sections 169A and 169B of the CAA and in 40 CFR 51.300-308. In our final action on June 7, 2012, we found that the requirements of section 169A of the CAA were not met because the 2008 Louisiana Regional Haze SIP did not include fully approvable measures for meeting the requirements of 40 CFR 51.308(d)(3) and 51.308(e) with respect to emissions of NOx and SO2 from electric generating units. We also determined that the Cross State Air Pollution Rule (CSAPR or the Transport Rule)[1], a rule issued in 2011 to address the interstate transport of NOx and SO2 in the eastern United States would, like CAIR, provide for greater reasonable progress towards the national goal than would BART for states in which CSAPR applies. 76 FR 82219. EPA finalized that rule on May 30, 2012 (77 FR 33642). Based on this finding, the EPA also revised the Regional Haze Rule (RHR) to allow CSAPR states to substitute participation in the trading programs under CSAPR for source-specific BART. States such as Louisiana that are subject to the requirements of the CSAPR trading program only for ozone season nitrogen oxides (NOx) can still substitute CSAPR for BART for NOx, but must address BART for EGUs for SO2 and other visibility impairing pollutants. 76 FR 82224.

States are required to identify all BART-eligible sources within their boundaries by utilizing the three eligibility criteria in the BART Guidelines (70 FR 39158) and the Regional Haze regulations (40 CFR 51.301): (1) One or more emission units at the facility fit within one of the 26 categories listed in the BART Guidelines; (2) the emission unit(s) began operation on or after August 6, 1962, and the unit was in existence on August 6, 1977; and (3) the potential emissions of any visibility-impairing pollutant from subject units are 250 tons or more per year. Sources that meet these three criteria are considered BART-eligible. In our proposed partial disapproval and partial limited approval (77 FR 11839) of the 2008 Louisiana Regional Haze SIP, we approved LDEQ's identification of 76 BART-eligible sources.

Once a list of BART-eligible sources within a state has been compiled, states must determine whether to make BART determinations for all of them or to consider exempting some of them from BART because they may not reasonably be anticipated to cause or contribute to any visibility impairment in a Class I area. The BART Guidelines present several options that rely on modeling analyses and/or emissions analysis

[1] 76 FR 48207, 48208 (August 8, 2011).

approaches to determine if a source may reasonably be anticipated to cause or contribute to visibility impairment in a Class I area. A source that may not be reasonably anticipated to cause or contribute to any visibility impairment in a Class I area is not "subject to BART," and for such sources, a state need not apply the five statutory factors to make a BART determination.

Louisiana's 2008 Regional Haze SIP submittal did not include a determination of which BART eligible EGUs were subject to BART, and Louisiana cannot rely on CSAPR as a substitute for BART for SO2. On May 19, 2015, EPA Region 6 sent CAA Section 114 letters to several BART-eligible sources in Louisiana. In those letters we noted our understanding that the sources were actively working with LDEQ to develop a SIP. However, in order to be in a position to develop a FIP, should that be necessary, EPA requested information regarding the BART-eligible sources. The Section 114 letters required sources to conduct modeling to determine if the sources were subject to BART, and included a modeling protocol. The letters also requested that a BART analysis in accordance with the BART Guidelines be performed for those sources determined to be subject to BART. The LDEQ worked closely with the BART facilities and with EPA Region 6. On February 10, 2017, Louisiana submitted a SIP revision (February 2017 Louisiana Regional Haze SIP) intended to cure the deficiencies noted in our partial limited approval/partial disapproval, and supplemented that submittal by a SIP revision submitted for parallel processing on June 20, 2017 to address BART requirements at the Entergy Nelson facility. On behalf of each BART facility, Trinity Consultants (or CB&I on behalf of NRG Big Cajun I and Big Cajun II), performed BART screening modeling for BART-eligible sources and five-factor analyses for subject-to-BART sources to address the BART requirements for EGU sources in the state. These modeling analyses were included as part of the 2017 Louisiana Regional Haze SIP. As part of our proposed action, we have reviewed the BART analyses performed by Trinity Consultants and CB&I that have been provided to us via the SIP submittal. The CALPUFF visibility modeling protocol reviewed here was followed in the technical work performed by Trinity Consultants and CB&I[2] for each facility and is described in detail in this document along with a summary of model results. Modeled emission rates and additional details of CALPUFF visibility modeling for specific BART sources are available in the modeling reports included in the appendices of the 2017 Louisiana Regional Haze SIP.

As discussed in the TSD and proposed rule, the 2017 Louisiana Regional Haze SIP submittal identifies a number of BART-eligible sources that have since retired from operation, and LDEQ rescinded their permits making the retirements permanent and enforceable, rendering them no longer subject to the requirements of the Regional Haze Rule. The following table identifies the remaining EGU sources in Louisiana that were

[2] A copy of each BART analysis performed by Trinity Consultants on behalf of the BART sources can be found in the docket for this proposed rulemaking as part of the 2017 Louisiana Regional Haze SIP.

identified in the 2008 Louisiana Regional Haze SIP submittal as BART-eligible. These sources are subject to the requirements of the Regional Haze Rule, including a determination of whether or not those sources are subject to BART.

Table 1-1. BART-eligible sources requiring screening modeling

Facility Name	**Units**	**Parish**
Terrebonne Parish Consolidated Government Houma Generating Station	Units 15 and 16	Terrebonne
Louisiana Energy and Power Authority Plaquemine Steam Plant	Boilers 1 and 2	Iberville
Lafayette Utilities System Louis "Doc" Bonin Station	Units 1, 2, and 3	Lafayette
Cleco Rodemacher/Brame	Nesbitt I (Unit 1) Rodemacher II (Unit 2)	Rapides
Cleco Teche	Unit 3	St. Mary
Entergy Sterlington	Unit 7 (7AB and 7C)	Ouachita
Entergy Waterford	Units 1, 2, and auxiliary boiler	St. Charles
Entergy Willow Glen	Units 2, 3, 4, 5, auxiliary boiler	Iberville
Entergy Ninemile Point	Units 4 and 5	Jefferson
Entergy Nelson	Units 4, 6, and auxiliary boiler	Calcasieu
Entergy Little Gypsy	Units 2, 3 and auxiliary boiler	St. Charles
Louisiana Generating (NRG) Big Cajun I	Units 1 and 2	Point Coupee
Louisiana Generating (NRG) Big Cajun II	Units 1 and 2	Point Coupee

Throughout this document, we may use language such as, "we find" or other similar phrases that on the surface would suggest a final determination has been made. However, all aspects of our TSDs should be considered to be part of our proposal and are subject to change based on comments and other information we may receive during our public comment period

II. BART Guidelines and Modeling Protocol

A. *Background and Introduction to BART Modeling*

Once the list of BART-eligible sources is compiled, an examination is required to determine whether a particular BART-eligible source causes or contributes to visibility impairment in nearby Class I areas.[3] For those sources that are not reasonably anticipated to cause or contribute to any visibility impairment in a Class I area, a BART determination is not required.[4] Those sources are determined to be not subject-to-BART. Sources determined to be reasonably anticipated to cause or contribute to any visibility impairment in a Class I area are determined to be subject-to-BART.[5] For each source subject to BART, 40 CFR 51.308(e)(1)(ii)(A) requires that States identify the level of control representing BART after considering the factors set out in CAA section 169A(g).

The BART guidelines discuss several approaches available to exempt sources from the BART determination process, including modeling individual sources and the use of model plants. To determine which sources are anticipated to contribute to visibility impairment, the BART guidelines state you can use CALPUFF or other appropriate model to estimate the visibility impacts from a single source at a Class I area.[6] For those units outside of the CALPUFF model's typical range, CAMx modeling can also be performed to inform the determination of whether sources' visibility impacts are large enough to identify them as being subject to BART. CAMx modeling for BART screening and for evaluation of visibility benefits of potential controls is discussed in the CAMx Modeling TSD.

Following the protocol described and reviewed below, BART screening modeling using CALPUFF was performed to screen the sources identified in table 1. These modeling analyses were included as part of the 2017 Louisiana Regional Haze SIP. See Section III of this TSD for a discussion of results of this screening modeling for each BART-eligible source. There are two Class I Areas within approximately 300-400 km of the facilities that were included in the CALPUFF modeling analyses to assess visibility impacts at nearby Class I areas. These Class I areas are listed in Table 2-1.

For those units determined to be subject-to-BART, an analysis of BART must be performed. The BART analysis for those units determined to be subject-to-BART includes engineering and modeling methods and procedures used to determine the appropriate controls for the subject-to-BART units to address the source's contribution to pollutant concentrations that result in visibility impairment in the surrounding Class I areas. The final factor to consider in identifying a level of control as BART under EPA's

[3] See 40 C.F.R. Part 51, Appendix Y, III, How to Identify Sources "Subject to BART"
[4] *Id.*
[5] *Id.*
[6] *Id.*

BART Guidelines is the degree of visibility improvement from the BART control options.[7] The BART guidelines again recommend use of the CALPUFF air quality dispersion model to estimate the visibility improvements at each Class I area, and to compare these to each other and to the impact of the baseline, or current, source configuration. Following the protocol described and reviewed below, BART modeling using CALPUFF was also performed to assess visibility benefits of controls for the sources identified as subject-to-BART. See Section IV of this TSD for a discussion of CALPUFF modeling for visibility benefits of controls for the sources identified as subject-to-BART.

Table 2-1. Class I Areas

Class I Area	**State**	**Agency**	**IMPROVE monitor**
Caney Creek Wilderness Area	AR	USFS	CACR
Breton Wilderness Area	LA	FWS	BRET

Table 2-2. Approximate distances to Class I areas (km)

Facility Name	**Breton Island**	**Caney Creek**
Cleco Rodemacher/Brame	422	352
Cleco Teche	245	569
Entergy Sterlington	440	230
Entergy Waterford	150	592
Entergy Willow Glen	217	530
Entergy Ninemile Point	117	615
Entergy Nelson	427	460
Entergy Little Gypsy	150	592
Louisiana Generating (NRG) Big Cajun I	263	476
Louisiana Generating (NRG) Big Cajun II	263	476

Under the BART guidelines[8], the measure of the visibility impact and improvement to be used in screening and comparisons between various control scenarios is the 98th percentile of impacts expressed as 24-hour averages of delta deciviews relative to natural background, as estimated using the CALPUFF air quality modeling system. The meaning of this is described next, followed by particulars of the application of CALPUFF to the individual BART determinations.

[7] 59 FR 39104, 39170 (July 6, 2005), [40 C.F.R. Part 51, Appendix Y].
[8] 40 C.F.R. Part 51, Appendix Y.

Table 2-3. CALPUFF system modeling components utilized by Trinity and CB&I

Processor	Version	Level
TERREL	3.3	030402
CTGCOMP	2.21	030402
CTGPROC	2.63	050128
MAKEGEO	2.2	030402
CALMET	5.53a	040716
CALPUFF	5.8.4	130731
POSTUTIL	1.56	070627
CALPOST	6.221	080724

B. Calculation of Visibility Impact

Under the RHR, visibility is measured in deciviews.[9] Visibility is traditionally described in terms of visual range in kilometers or miles. However, the visual range scale does not correspond to how people perceive visibility: a given increase in visual range is perceived differently depending on how good the original visibility was (that is, it is not on a linear scale). The deciview scale is designed to address this problem. It is linear with respect to perceived visual changes over its entire range, analogous to the decibel scale for sound: a given change in deciviews will be perceived as the same amount of visibility change, whatever the original visibility was. The defining equation is:

$$deciviews = 10*ln(b_{ext} / 10)$$

where ln is the natural logarithm, and extinction b_{ext} is the fraction of light scattered out of a viewing path. Extinction increases with the amount of pollution (b_{ext} is in units of 1/Mm, "inverse megameters"). Lower deciview values represent better visibility, more pristine atmospheres, and greater visual range, while increasing deciview values represent increasingly poor visibility. An increase of 1 deciview corresponds to about a 10% increase in extinction. (Deciviews are related to the more traditional visual range according to dv = 10*ln(391 / visual range)). An eligible BART source with a predicted impact of 0.5 dv or more of impairment in a Class I area "contributes" to visibility impairment and is subject to BART.[10]

Under the BART guidelines, deciviews are estimated using the CALPUFF air quality model. CALPUFF predicts 24-hour average pollutant concentrations based on source emissions and how they disperse in the atmosphere. The CALPUFF modeling includes source emissions of the following visibility-impairing pollutants: SO_2, SO_4, NO_x, secondary organic aerosol (SOA), fine particulate matter (PMF), coarse particulate matter (PMC), and elemental carbon (EC). CALPUFF incorporates a semi-empirical chemical module that simulates the conversion of SO_2 to particulate sulfate and NO_x to particulate

[9] 40 C.F.R. 51.301.
[10] 70 FR 39104, 39121 (July 6, 2005), [40 C.F.R. Part 51, Appendix Y].

nitrate, at a rate dependent on meteorological conditions and background ozone concentration. These concentrations are converted to deciviews by the CALPOST post-processor in two steps.

1. IMPROVE Equation

Under the original IMPROVE[11] equation, extinction (b_{ext}) is estimated from the predicted concentrations of various pollutants:

b_{ext} = 3 * f(RH) * [sulfate]
*+ 3 * f(RH) * [nitrate]*
*+ 4 * [organic mass]*
*+ 10 * [elemental carbon]*
*+ 1 * [fine soil]*
*+ 0.6 * [coarse mass]*
+ 10

The 10 is for Rayleigh scattering, which is due to the interaction of light with molecules of air itself with no pollutants. The f(RH) is a water growth factor for sulfate and nitrate; its value depends on relative humidity (RH), ranging from 1 at low humidity to 18 at 98% humidity.

2. Revised IMPROVE Equation

The Trinity revised modeling used the "revised" IMPROVE equation[12] to calculate light extinction. Sometimes the revised IMPROVE equation is called the "New" IMPROVE equation. The revised IMPROVE equation is used to convert measured or modeled concentrations into extinction for each pollutant chemical species, and then total them up, accounting for the effect of relative humidity.

Revised IMPROVE equation:

b_{ext} = 2.2 * f_s(RH) * [small sulfate] + 4.8 * f_L(RH) * [large sulfate]
+ 2.4 * f_s(RH) * [small nitrate] + 5.1 * f_L(RH) * [large nitrate]
+ 2.8 * [small organic mass] + 6.1 * [large organic mass]
+ 10 * [elemental carbon]
+ 1 * [fine soil]
+ 1.7 * f_{ss}(RH) * [sea salt]

[11] Interagency Monitoring of Protected Visual Environments (IMPROVE) is a network of monitors in various Class I Areas, established to assess visibility impairment and its causes. The IMPROVE equation is used to convert monitored concentrations into extinction, a measure of visibility. See: http://vista.cira.colostate.edu/improve/

[12] Pitchford, M. L., W. C. Malm, B. A. Schichtel, N. Kumar, D. Lowenthal and J. L. Hand, Revised algorithm for estimating light extinction from IMPROVE particle speciation data, *Journal of the Air & Waste Management Association, 57*, 1326-1336, 2007.

+ 0.6 * [coarse mass]
+ Rayleigh scattering (site-specific)
+ 0.33 * [NO_2(ppb)]

Sulfate is assumed to be all "large sulfate" if total sulfate is over 20 $\mu g/m^3$, otherwise its fraction of the total is assumed to increase uniformly between 0 and 1 when the total is in the range between 0 and 20 (i.e. large sulfate = (total sulfate/20)*total). A similar definition applies for nitrate and for organic mass. The organic mass is assumed to be 1.8 times the organic carbon mass that is measured by IMPROVE monitors, an increase over the old 1.4. Sea salt is estimated as 1.8* [chloride] (or chlorine if chloride not available). The f_s, f_L, f_{ss} are water growth factors for small ("S") and large ("L") fractions of sulfate and nitrate, and for sea salt ("SS"). Their values depend on relative humidity, ranging from 1 at low humidity to over 5 at 95% humidity. Rayleigh scattering is due to the interaction of light with molecules of air itself with no pollutants.

The IMPROVE program revised the IMPROVE equation after a scientific assessment of its implications for regional haze planning to reduce biases in light extinction estimates compared to the old algorithm.[13] In particular, when compared to nephelometer direct measurements of visibility extinction, the original IMPROVE equation over-predicts for low extinction conditions and under-predicts for high extinction. These biases have direct relevance for estimates for the worst 20% visibility days that are used to assess visibility impact. The new equation shows broader scatter overall, but less bias in matching visibility measurements under high and low visibility conditions. The split between small and large particles was the main factor in reducing the biases. The revised IMPROVE equation has less bias, is more refined, accounts for more pollutants and pollutant sizes, incorporates more recent data, and is based on considerations of relevance for the calculations needed for assessing progress under the Regional Haze Rule.

EPA 2007 guidance[14] states that the use of either the IMPROVE or the revised IMPROVE equation is acceptable provided that the same algorithm is utilized for both the base and future extinction calculations. EPA believes it is appropriate to use the revised IMPROVE equation and that this is the preferred method.

3. Deciview Impact Calculation

In the second CALPOST step this extinction is converted to deciviews, using the defining equation above for deciviews. The delta deciviews (Δdv) represents the impact on

[13] *Revised IMPROVE algorithm for Estimating Light Extinction from Particle Speciation Data*, IMPROVE, January 2006 (http://vista.cira.colostate.edu/improve/Publications/GrayLit/gray_literature.htm); Hand, J.L., Douglas, S.G., 2006, Review of the IMPROVE Equation for Estimating Ambient Light Extinction Coefficients – Final Report (http://vista.cira.colostate.edu/improve/Publications/GrayLit/016_IMPROVEEeqReview/IMPROVEEqReview.htm).
[14] *Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM2.5, and Regional Haze*, EPA-454/B-07-002, April 2007, EPA OAQPS; (http://www.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf).

visibility in deciviews of the source being evaluated, and is also provided by CALPUFF. It is the change, or "delta", between deciviews with and without the source. Under the BART guidelines, delta deciviews is the difference between deciviews including the impact of the source and natural background, and deciviews of the natural background alone. Each modeled day and location in the Class I area will have an associated delta deciview. For each day, the model finds the maximum visibility impact of all locations (receptors) in the Class I area. From among these daily values, the BART guidelines recommend use of the 98th percentile, roughly equivalent to the 8th highest day, visibility impacts expressed as 24-hour averages of delta deciviews relative to natural background, as estimated using the CALPUFF air quality modeling system for comparing the base case and the effects of various controls. In the BART guidelines, we made the decision to consider the less conservative 98th percentile primarily because the chemistry modules in the CALPUFF model are simplified and likely to provide conservative (higher) results for peak impacts.[15]

The BART guidelines recommend that impacts of sources be estimated in deciviews relative to natural background. The CALPUFF BART evaluations used average background concentrations (Table 2-3) and relative humidity adjustment factors (Tables 2-5, 2-6, and 2-7) from the Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report[16] for use with the revised IMPROVE equation ("Method 8").

Table 2-4. Natural Background Concentrations used for "Method 8"

Class I Area	CALPOST control input parameters (μg/m^3)						
	BKSO4	BKNO3	BKOC	BKEC	BKSOIL	BKCM	BKSALT
	Ammonium sulfate	Ammonium nitrate	Organic carbon	Elemental carbon	Soil	Coarse mass	Sea salt
Caney Creek	0.23	0.10	1.80	0.02	0.50	3.00	0.03
Breton Island	0.23	0.10	1.78	0.02	0.48	3.01	0.19

Table 2-5. $f_L(RH)$ Large RH Adjustment Factors

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Caney Creek	2.77	2.53	2.37	2.43	2.68	2.71	2.59	2.6	2.71	2.69	2.67	2.79
Breton Island	2.91	2.76	2.74	2.72	2.83	2.94	3.10	3.07	2.97	2.82	2.83	2.90

[15] "Most important, the simplified chemistry in the model tends to magnify the actual visibility effects of that source. Because of these features and the uncertainties associated with the model, we believe it is appropriate to use the 98th percentile—a more robust approach that does not give undue weight to the extreme tail of the distribution." 70 FR 39104, 39121 (July 6, 2005), [40 C.F.R. Part 51, Appendix Y].
[16] Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report—Revised (2010) Natural Resource Report NPS/NRPC/NRR—2010/232 (http://www.nature.nps.gov/air/Pubs/pdf/flag/FLAG_2010.pdf)

Table 2-6. fs(RH) Small RH Adjustment Factors

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Caney Creek	3.85	3.44	3.14	3.24	3.66	3.71	3.49	3.51	3.73	3.72	3.68	3.88
Breton Island	4.08	3.82	3.79	3.74	3.94	4.12	4.41	4.37	4.18	3.92	3.93	4.06

Table 2-7. fss(RH) Sea Salt RH Adjustment Factors

Class I Area	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Caney Creek	3.9	3.52	3.31	3.41	3.83	3.88	3.69	3.68	3.82	3.76	3.77	3.93
Breton Island	4.1	3.89	3.87	3.85	4.02	4.21	4.44	4.38	4.23	3.99	4.01	4.11

C. CALMET/CALPUFF modeling protocol

On May 19, 2015, EPA Region 6 sent CAA Section 114 letters to several BART-eligible sources in Louisiana. In those letters we noted our understanding that the sources were actively working with LDEQ to develop a SIP. However, in order to be in a position to develop a FIP, should that be necessary, EPA requested information regarding the BART-eligible sources. The Section 114 letters required sources to conduct modeling to determine if the sources were subject to BART, and included a modeling protocol. The letters also requested that a BART analysis in accordance with the BART Guidelines be performed for those sources determined to be subject to BART. The EPA Region 6 worked closely with the BART facilities and with LDEQ. As a result, the LDEQ submitted a revised SIP submittal on February 10, 2017, (the 2017 Louisiana Regional Haze SIP) intended to address EGU BART for Louisiana. The 2017 Louisiana Regional Haze SIP includes modeling analyses conducted by Trinity Consultants and CB&I for each of the facilities of interest consistent with the protocol provided by us in the Section 114 letters.[17] These modeling analyses generally followed the BART protocol developed by CENRAP.[18] However, unlike previous modeling conducted for many sources in Louisiana, surface and upper air observations were utilized (NO OBS = 0) for the refined source-specific modeling, consistent with EPA and FLM recommendations. The CALPUFF modeling used an existing CALMET data set supplied by EPA that utilized CALMET v5.53a, which is a slightly earlier regulatory version and compatible with the regulatory version of CALPUFF (v5.8). EPA previously evaluated the differences in the

[17] A copy of each BART analysis performed by Trinity Consultants or CB&I on behalf of the BART sources is included in the 2017 Louisiana Regional Haze SIP.

[18] CENRAP BART Modeling Guidelines, T. W. Tesche, D. E. McNally, and G. J. Schewe (Alpine Geophysics LLC), December 15, 2005

CALMET model versions. Based on the changes between CALMET versions, we do not expect the newer version would yield different impact estimates and would not affect any of our decisions in this proposal. The Section 114 letters identified the availability of this existing dataset. This dataset was generated by Trinity Consultants for use in BART analyses of sources in Oklahoma.[19] The modeling protocol for this CALMET data set is available in the docket for this action and describes in full the modeling domain and input data utilized in developing the meteorological dataset. We note that because this CALMET data was prepared using both surface and upper air observations (NO OBS = 0), consistent with our guidance, we recommend the use of the 98th percentile or 8th highest value in analyzing the visibility benefits anticipated due to the use of controls, rather than the maximum value utilized in the previous CENRAP modeling analyses and screening analyses included in the 2008 Louisiana Regional Haze SIP. The 2017 Louisiana Regional Haze SIP submittal includes appendices with descriptions of the modeling protocol followed for each modeled source.

Table 2-8 shows selected CALMET settings used for modeling visibility impacts from these facilities as reflected in the 2017 Louisiana Regional Haze SIP submittal. R1MAX and R2MAX represent the radius of influence of surface and upper air observations, respectively. R1 (R2) defines the distance from an observation at which the surface (upper air) observation and the initial wind field are equally weighted and is typically set to half the value of R1MAX (R2MAX). EPA and FLMs recommend the use of higher values for R1MAX (100 km) and R2MAX (200 km) based on tracer evaluations and testing.[20] EPA is aware of these deviations and weighed the potential differences that may occur due to these deviations with the additional work and computing resources that would be required to redo the analyses. Given the time and resource constraints, EPA concludes that these deviations are acceptable and shared this dataset with LDEQ and BART sources for the purpose of evaluating visibility impacts for BART screening and benefits due to the use of controls as part of a full five-factor BART analysis for subject-to-BART sources in Louisiana.

Table 2-8. Selected CALMET Settings Used

Option	Description	EPA default	Trinity/CB&I
Version	CALMET version	5.8.4, level 130731	5.53a, level 040716
NOOBS	No Observation Mode	0	0
ICLOUD	gridded cloud fields	0	0
IWFCOD	diagnostic winds	1	1
IFRADJ	Froude wind adj.	1	1
IKINE	kinematic effects	0	0
IOBR	O'Brien vertical wind adj.	0	0
ISLOPE	slope flows	1	1

[19] The modeling protocol for this CALMET dataset can be found as: CALMET DATA Processing Protocol BART Determination Oklahoma Gas and Electric, Prepared by Trinity Consultants, January 23, 2008.
[20] Memorandum from Tyler Fox (EPA OAQPS) "Clarification on EPA-FLM Recommended Settings for CALMET," August 31, 2009.

IEXTRP	extrapolate wind to upper air	-4	-4
ICALM	extrapolate calm to upper air	0	0
BIAS	layer biases sfc vs. UA	NZ*0	NZ*0
IPROG	gridded initial prognostic	0	14
RMAX1	max surface radius of influence	NA	20
RMAX2	max aloft radius of influence	NA	50
RMAX3	max over-water radius of influence.	NA	100
RMIN	min wind radius of influence.	0.1	0.1
RMIN2	min dist sfc winds extrap	4	4
TERRAD	terrain radius of in influence	NA	10
R1	weight surface Step 1 vs. obs	NA	10
R2	weight aloft Step 1 vs. obs	NA	25
ITPROG	3D T from obs or prognostic	0	0
TRADKM	radius of influ. for T interp.	500	500
IAVET	spatial T averaging	1	1
JWAT1	starting land use for T interp. over water	999	55
JWAT2	ending land use for T interp. over water	999	55

The BART modeling submitted as part of the 2017 Louisiana Regional Haze SIP used the regulatory version of CALPUFF (v5.8.4) at the time the analyses were initiated[21] and CALPOST (v6.221). We note that the current regulatory version of CALPUFF was recently updated to v5.8.5.[22] Based on the changes between 5.8.4 and 5.8.5 and the types of sources we modeled with CALPUFF, we do not expect the newer version would yield different impact estimates and would not affect any of our decisions in this proposal. For visibility calculations, the pollution concentration predictions of CALPUFF are used in post-processing. First, POSTUTIL considers ammonia background concentrations, temperature, and humidity to determine how much nitrate ends up as particulate ammonium nitrate; this is to reflect the competition between sulfate and nitrate for available ammonia and is referred to as "Nitrate Repartitioning." CALPOST then converts the predicted pollutant concentrations into extinction using the revised IMPROVE equation followed by converting the estimated total extinction into deciviews.

The refined source-specific modeling used a constant value of 3 ppb background concentration of ammonia for the domain during the modeling period consistent with previously agreed values in Louisiana's CALPUFF modeling protocol. Hourly ozone

[21] On December 4, 2013, EPA approved an update to v5.8.4 that contained bug fixes to the previous version. See December 3, 2013 CALPUFF Update Memo for a discussion of model changes.
[22] On July 26, 2016, EPA approved an update to v5.8.5 that contains fixes to bugs in the implementation of PRIME downwash, along with updates to eliminate specific compilation and list file errors. See Model Change Bulletin H dated December 14, 2015 for a discussion of model changes.

observational data over the 2001-2003 timeframe were used to define background ozone concentrations.

Trinity utilized a CALPUFF modeling domain that extends at least 50 km in all directions beyond all Entergy units and the Class I areas of interest.[23] In general this approach seemed reasonable. However, model results for some sources or Class I areas may be sensitive to this assumption depending on their locations relative to the domain boundary, and the use of a larger modeling domain could result in higher impacts on certain days. This is due to the model's inability to track puffs that exit the smaller domain and then re-enter the modeling domain before impacting the Class I area. Using a larger modeling domain prevents puffs from being lost by exiting the domain. For those sources that required additional modeling to be performed by EPA to evaluate visibility benefits of potential controls, we did see some difference in some initial results using a larger modeling domain, so a larger modeling domain was utilized for all of EPA's additional modeling.

D. EPA Conclusion

In general, we find the CALPUFF modeling submitted in the 2017 SIP submittal to be consistent with EPA and FLM guidance and acceptable for the purposes of evaluating the anticipated visibility impacts for BART screening and the visibility benefits that can be achieved with the use of controls at the subject-to-BART facilities in Louisiana.

We note that included in the 2017 SIP submittal's BART analysis for the Cleco and Entergy sources prepared by Trinity Consultants is an evaluation of the CALPUFF model.[24] This analysis claims that due to limitations in the CALPUFF model, reliance on the CALPUFF results for determining if units are subject-to-BART is inappropriate. The model limitations identified in the analysis include reliance on an outdated version of the model, using the model at distances beyond 200 km, not using the puff-splitting option in the model, and over-prediction of nitrates. The analysis also includes an evaluation that purports to estimate the margin of error of the CALPUFF model for estimating impacts from specific Entergy sources and presents several case studies comparing CALPUFF modeled impacts to measured visibility conditions. We disagree with this assessment and have addressed these specific comments concerning the CALPUFF model in our past actions. [25] We also note that all Entergy BART sources with the exception of Entergy

[23] See Figure D-1 in appendix D of the Updated BART Applicability Screening Analysis Prepared by Trinity Consultants, November 9, 2015. Available in Appendix D of the 2017 Louisiana regional Haze SIP.
[24] See "Updated BART Applicability Screening Analysis" Prepared by Trinity Consultants, November 9, 2015. Available in appendix D of the 2017 Louisiana Regional Haze SIP
[25] For example, see Section 7.c "Model Selection" and Section 7.d "Margin of Error CALPUFF Modeling" of our Response to Comments (AR RTC) on the Arkansas Regional Haze FIP (81 FR 66332, Sept. 27,

R.S. Nelson are located approximately 200 km or less from the nearest Class I area, well within the recommended range for CALPUFF[26]. We also disagree with statements made in the June 2017 Louisiana Regional Haze SIP submittal concerning the BART guidelines. The SIP submittal states that Appendix Y states that CALPUFF should be used for distances less than 300 km and CAMx is approved for distances greater than 300 km. This statement is incorrect. The BART Guidelines do not discuss a distance limitation of 300 km for CALPUFF or approve the use of CAMx for specific situations. The Guidelines recommend the use of "CALPUFF or other appropriate model,"[27] following appropriate guidance[28], and calls for the development of a modeling protocol. We agree with LDEQ that the CALPUFF model following the reviewed protocol is an appropriate tool to evaluate visibility impacts and benefits to inform a BART determination.

In addition to the CALPUFF modeling included in the 2017 Louisiana Regional Haze SIP submittal, the results of CAMx modeling performed by Trinity consultants was included in the submittal as additional screening analyses[29] that purport to demonstrate that the baseline visibility impacts from Cleco Brame and a number of the Entergy sources[30] are significantly less than the 0.5 dv threshold established by Louisiana. However, this modeling was not conducted in accordance with the BART Guidelines and a previous modeling protocol developed for the use of CAMx modeling for BART screening (EPA, Texas, and FLM representatives approved)[31,32], and does not properly

---

2016) available in the docket for this action. EPA does not recommend using puff splitting and as discussed in the AR RTC, concerns with nitrate performance was a primary reason we used 98th percentile values instead of the maximum impact value.

[26] CALPUFF max range was typically recommended for distances of 300 km – 400km during the BART process.

[27] 40 CFR Appendix Y, IV.D.5

[28] For example: *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts,* U.S. Environmental Protection Agency, EPA–454/R–98–019, December 1998.

[29] See October 10, 2016 Letter from Cleco Corporation to Vivian Aucoin and Vennetta Hayes, LDEQ, RE: Cleco Corporation Louisiana BART CAMx Modeling, included in Appendix B of the 2017 Louisiana Regional Haze SIP submittal; CAMx Modeling Report, prepared for Entergy Services by Trinity Consultants, Inc. and All 4 Inc, October 14, 2016, included in Appendix D of the 2017 Louisiana Regional Haze SIP submittal

[30] Entergy's CAMx modeling included model results for Michoud, Little Gypsy, R.S. Nelson, Ninemile Point, Willow Glen, and Waterford.

[31] Texas had over 120 BART eligible facilities located at a wide range of distances to the nearest class I areas in their original Regional Haze SIP. Due to the distances between sources and Class I areas and the number of sources, Texas worked with EPA and FLM representatives to develop a modeling protocol to conduct BART screening of sources using CAMx photochemical modeling. Texas was the only state that screened sources using CAMx and had a protocol developed for how the modeling was to be performed and what metrics had to be evaluated for determining if a source screened out. See Guidance for the Application of the CAMx Hybrid Photochemical Grid Model to Assess Visibility Impacts of Texas BART Sources at Class I Areas, ENVIRON International, December 13, 2007, available in the docket for this action.

[32] EPA, TCEQ, and FLM representatives verbally approved the approach in 2006 and in email exchange with TCEQ representatives in February 2007 (see email from Erik Snyder (EPA) to Greg Nudd of TCEQ

assess the maximum baseline impacts. Therefore, we consider the submitted CAMx modeling to be invalid for supporting any determination of visibility impacts below 0.5 dv. We agree with LDEQ's decision to not rely on this CAMx modeling, but rather rely on the CALPUFF modeling for BART determinations.[33] We provide a detailed discussion of our review of this CAMx modeling in the CAMx Modeling TSD.

As discussed above, Louisiana relied on CALPUFF modeling to inform BART determinations consistent with the BART Guidelines. However, the use of CALPUFF is typically used for distances less than 300-400 km. The Cleco Brame source is located 352 km from Caney Creek and 422 km from Breton. For the largest emission sources, NRG Big Cajun II, and Cleco Brame Energy, we performed our own CAMx modeling following the BART Guidelines and consistent with previously agreed techniques and metrics of the Texas CAMx BART screening protocol to provide additional information on visibility impacts and impairment and address possible concerns with utilizing CALPUFF to assess visibility impacts at Class I areas located far from these emission sources. See the CAMx Modeling TSD for additional information on EPA's CAMx modeling protocol, inputs, and model results.

Feb. 13, 2007 and response email from Greg Nudd to Erik Snyder Feb. 15, 2007, available in the docket for this action).

[33] See Response to Comments in Appendix A of the 2017 Louisiana Regional Haze SIP submittal

III. BART Screening Modeling

A. *Visibility Impairment Threshold*

The preamble to the BART Guidelines advises that, "for purposes of determining which sources are subject to BART, States should consider a 1.0 deciview change or more from an individual source to 'cause' visibility impairment, and a change of 0.5 deciviews to 'contribute' to impairment."[34] It further advises that "States should have discretion to set an appropriate threshold depending on the facts of the situation," and describes situations in which states may wish to exercise that discretion, mainly in situations in which a number of sources in an area were all contributing fairly equally to the visibility impairment of a Class I area In Louisiana's 2008 Regional Haze SIP submittal, the LDEQ used a contribution threshold of 0.5 dv for determining which sources are subject to BART, and we approved this threshold in our previous action.[35] We find that the use of the same threshold is appropriate for these EGU sources.

B. *Baseline Emissions*

The BART Guidelines in 40 CFR 51 Appendix Y recommend that States use the 24-hour average actual emission rate from the highest emitting day of the meteorological period modeled, unless this rate reflects periods start-up, shutdown, or malfunction. The maximum 24-hour emission rate (lb/hr) for NOx and the maximum 24-hour emission rate (lb/hr) for SO_2 (not paired in time) from the 2000-2004 baseline period for each source was identified by each source through a review of the daily emission data for each BART-eligible unit from EPA's Air Markets Program Data.[36] Because daily emissions are not available for PM, maximum 24-hr PM emissions were estimated based on permit limits, maximum heat input and AP-42 factors, and/or stack testing.[37]

Speciated PM emissions were calculated using the National Park Service (NPS) speciation worksheets corresponding to unit type and the emission control equipment present in each modeling scenario.[38] PM speciation in the NPS worksheets is based on AP-42 emission factors and depends on the type of emission control equipment and the properties of the fuel used. PM coarse, PM fine, soil, elemental carbon and SOA

[34] 70 FR 39104, 39120 (July 6, 2005), [40 C.F.R. Part 51, Appendix Y].
[35] See, 77 FR 11839, 11849 (February 28, 2012).
[36] http://ampd.epa.gov/ampd
[37] A copy of the final version of each BART analysis performed by Trinity Consultants or CB&I on behalf of the BART sources can be found in the appendices of the submitted 2017 LA Regional Haze SIP.
[38] Original PM Speciation worksheets available at http://www.nature.nps.gov/air/permits/ect/ectCoalFiredBoiler.cfm

emissions were input into CALPUFF. See the BART analyses for additional information on PM speciation.[39]

Estimates of H_2SO_4 emissions from the coal-fired units are based on the best current information available from the Electric Power Research Institute (EPRI) and coal properties. Sulfuric acid emissions from the coal-fired power plants are calculated by estimating the amount of H_2SO_4 produced and the amount of H_2SO_4 removed by control equipment using information from EPRI.[40] These calculations rely on assumed values for the amount of fuel sulfur converted to SO_2, the amount of SO_2 oxidized to SO_3, and the amount of H_2SO_4 lost to (or mitigated by) the air pre-heater and applicable control equipment, such as baghouses, and FGDs.

[39] A copy of the final version of each BART analysis performed by Trinity Consultants or CB&I on behalf of the BART sources can be found in the appendices to the 2017 Louisiana RH SIP submittal.
[40] Estimating Total Sulfuric Acid Emissions from Stationary Power Plants. EPRI, Palo Alto, CA: March, 2012. 1023790.

C. Results of CALPUFF Modeling Screening Analyses

1. "Doc" Bonin, Houma, and Plaquemine

As part of our development of the BART Guidelines, we developed analyses of model plants with representative plume and stack characteristics for both EGU and non-EGU sources using the CALPUFF model.[41] As we discuss in the BART Guidelines,[42] based on those analyses, we believe that sources that emit less than 1,000 tons per year of NO_X and SO_2 and that are located more than 100 km from any Class I area can be exempted from the BART determination. The BART Guidelines note that the model plant concept can be extended using additional modeling analyses to ratios of emission levels and distances other than 1,000 tons/100 km. The BART Guidelines explain that: "you may find based on representative plant analyses that certain types of sources are not reasonably anticipated to cause or contribute to visibility impairment. To do this, you may conduct your own modeling to establish emission levels and distances from Class I areas on which you can rely to exempt sources with those characteristics."[43] Modeling analyses of representative plants are used to reflect groupings of specific sources with important common characteristics.

Louisiana unintentionally omitted discussion of two BART eligible facilities in its 2017 Louisiana Regional Haze SIP: Terrebonne Parish Consolidated Government Houma Generating Station (Houma) and Louisiana Energy and Power Authority Plaquemine Steam Plant (Plaquemine). However, Louisiana's 2008 Regional Haze SIP submittal identified these two sources as BART eligible, and EPA approved the inclusion of these two sources on that list in 2012.[44] The LDEQ has indicated that it inadvertently failed to address whether these two sources are subject to BART in the 2017 Regional Haze SIP. These two sources were included in its 2008 Regional Haze SIP, but Louisiana relied on CAIR better than BART coverage for these sources when they adopted their 2008 SIP. Therefore, we have evaluated these two sources based on available information to determine whether they are subject to BART. We are not relying on the more general 1000 tpy/100 km model plant approach but are instead relying on existing modeling included in the 2008 Louisiana Regional Haze SIP as being a representative plant for the model plant analysis for the purpose of establishing emission levels and distances to exempt BART-eligible sources. Specifically, the 2008 Louisiana Regional Haze SIP included review of CALPUFF modeling of a source, Valero, which demonstrated that Valero's BART- eligible sources do not cause or contribute to visibility impairment at the nearby Class I area, Breton.

---

[41] CALPUFF Analysis in Support of the June 2005 Changes to the Regional Haze Rule, U.S. Environmental Protection Agency, June 15, 2005, Docket No. OAR–2002–0076.
[42] 70 FR 39119 (July 6, 2005),
[43] 70 FR 39163 (July 6, 2005).
[44] See Appendix E of the 2008 Louisiana RH SIP contained in the docket for this rulemaking; 77 FR 11839, 11848.

For Valero, the 2008 SIP submittal included BART Screening Modeling using the CALMET files developed by the Central Regional Air Planning Association (CENRAP). This CALPUFF Model Screening approach utilized the highest emission values and No-Observations (No-Obs) CALMET data No-Obs is a model run that does not include meteorological observations in the CALMET modeling. EPA's guidelines were to include observations but CENRAP processed the meteorological data with CALMET without including surface, upper air, and overwater observations. Louisiana, CENRAP, EPA and the FLM representatives agreed that this CALMET data with no observations could still be used for screening of sources but the metric to compare with the established visibility threshold would be the maximum delta deciview impact, not the 98th percentile delta deciview. Other than the No-Obs issue, the CALPUFF modeling for Valero was determined to conform with EPA modeling guidelines/practices and the modeling protocol between LDEQ and EPA/FLM representatives, and determined to be acceptable for the purposes of screening the BART-eligible units at Valero. Therefore, we are finding that this Valero modeling is also acceptable for us to use in screening out Houma and Plaquemine, as a more specific model plant analysis. Louisiana previously used modeling of specific facilities to screen out other facilities for some of their BART eligible non-EGU sources, and we approved that analysis.

Houma and Plaquemine are both further from Breton than Valero and oriented such that transport winds are similar for all three facilities towards Breton. Plaquemine is upwind of Valero when transport patterns would carry emissions to Breton. Houma is located in the same general direction from Breton with similar transport conditions (winds from the west) transporting pollutants from Houma and Valero towards Breton. See the figure below for a map showing the location of the sources and the model plant. The Valero plant has higher emissions of SO2, NOx and PM than the Houma and Plaquemine sources. The Valero plant is also representative (similar stack height and parameters)[45] of the Houma and Plaquemine sources and can therefore be relied on in a more specific model plant analysis to demonstrate that, based on baseline emissions and distance to the Class I area, the Houma and Plaquemine sources are not anticipated to cause or contribute to visibility impairment at Breton and are therefore not subject to BART.[46] We analyzed the ratio of visibility impairing pollutants, denoted as 'Q' (NOx, SO_2, and PM-10 in tons/year)[47] to the distance, denoted as 'D' (distance of source to Breton in km). For example, if two sources were similar but one has a lower Q/D value, the lower ratio value (either due to lower emissions and/or greater distance) would be expected to have smaller visibility impacts at Breton. The Q/D ratio for Houma and Plaquemine are significantly lower compared to Valero's ratio (See Table 3 below). The Q/D ratios of Houma are approximately 20% of Valero's, and Plaquemine's ratio is less than 10% of Valero's Q/D ratio, and modeled impacts of the Valero source were less than the 0.5 dv

---

[45] See MPStackComp.xlsx in the Docket.

[46] See 40 CFR Part 51 Appendix Y.

[47] To calculate Q, the maximum 24-hr emissions for NOx, SO2 and PM from the 2000-2004 baseline were identified for each BART-eligible unit at a source (See Table 9.3 of the 2008 Louisiana RH SIP). Emissions are not paired in time (i.e. max 24- hour NOx emissions value would not usually be on the same day as max 24-hour SO_2 emissions). The sum of these daily max NOx, PM and SO_2 emissions were summed and then multiplied by 365 days.

threshold. Therefore, the data demonstrates that visibility impacts from the BART-eligible units at Houma and Plaquemine are reasonably anticipated to be less than the modeled impacts from Valero and less than the 0.5 dv threshold to screen out.

We also note that on December 11, 2015, the Lafayette Utilities System Louis "Doc" Bonin Generating Station advised our Clean Air Markets Division that: Unit 1 last operated on June 22, 2011, and was put into cold storage on June 1, 2013; Unit 2 last operated on July 5, 2013, and was put into cold storage on June 29, 2014; and Unit 3 last operated on August 27, 2013, and was put into cold storage on June 24, 2014. The Midcontinent Independent System Operator (MISO) is currently conducting a study to predict the future use of these unit(s) for peaking purposes. If it is determined that these units are no longer necessary to facilitate electrical power generation, they will be retired.[48] However, at this time Lafayette Utilities System has not yet submitted a request to rescind the permit for the Louis "Doc" Bonin Electric Generating Station. Because placing the units in cold storage is not a permanent and enforceable closure under the Regional Haze requirements, we applied our specific model plant analysis utilizing the Valero source as a representative source to assess the anticipated visibility impacts of the Louis "Doc" Bonin source.

For our model plant comparison, Doc Bonin is further away from Breton than Valero but located in an area that sees similar wind transport to Breton. Doc Bonin has similar stacks and parameters[49] compared to the Valero sources. Overall emissions are similar, but Valero has more SO2 and slightly less NOx than Doc Bonin. We consider Valero to be conservative in terms of emissions of SO2 and NOx since SO2 yields much more visibility impairment in this region than NOx. With these factors being similar or conservative we analyze the Q/D ratios for the two facilities. The Q/D ratio for Louis "Doc" Bonin is significantly lower compared to Valero's Q/D ratio (See Table 3 below). The ratio is less than 40% of Valero's ratio and modeled impacts of the Valero source were less than the 0.5 dv threshold, which demonstrates that visibility impairment from the BART-eligible units at Louis "Doc" Bonin are reasonably anticipated to be less than the modeled impacts from Valero and below the 0.5 dv threshold to screen out. The model plant analysis demonstrates that, based on baseline emissions, the source is not anticipated to cause or contribute to visibility impairment of any Class I area, and is therefore not subject to BART. See the CALPUFF Modeling TSD for additional discussion of the model plant analysis. Because the modeling results demonstrate that Louis "Doc" Bonin is not subject to BART, we propose to approve this portion of the 2017 Louisiana Regional Haze SIP.

[48] See Appendix E of the 2017 Louisiana Regional Haze SIP
[49] See MPStackComp.xlsx in the Docket.

Figure 3-1. Map of BART-eligible EGUs for Model Plant analysis

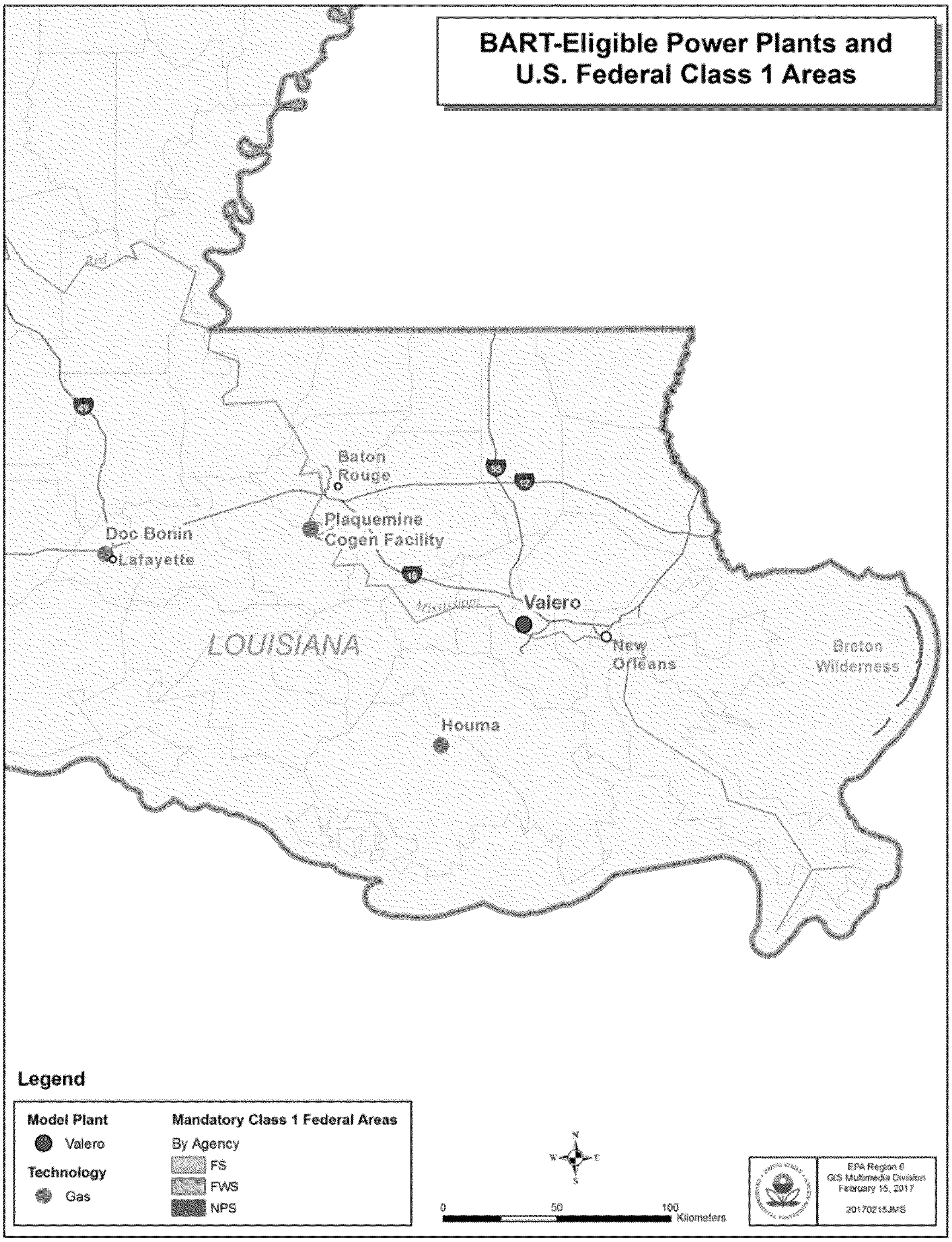

Table 3-1. Model Plant Analysis: Q/D Ratios

Facility	NOx (TPY)	SOx (TPY)	PM (TPY)	Facility Emissions (TPY)	Distance to Breton (km)	Q/D (TPY/km)	Max Percentile Delta DV
Houma	909.8	3.65	7.3	930.75	165	5.64	---
Plaquemine	492.75	0	0	492.75	227.1	2.17	---
Louis "Doc" Bonin	2993	7.3	109.5	3109.8	298.9	10.04	
Valero	1876	1091	401.5	3368.5	139.3	24.18	0.484

2. Cleco Teche Unit 3

Cleco Corporation (Cleco) owns and operates a 359 MW EGU boiler located at the Teche Power Station (Teche Unit 3) in Baldwin, St. Mary Parish, Louisiana. This unit burns natural gas, No. 2 fuel oil, and No. 4 fuel oil. This unit is not equipped with any air pollution control devices. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity Consultants conducted CALPUFF modeling on behalf of Cleco to determine if the visibility impacts from Teche Unit 3 exceeded the established visibility impact threshold of 0.5 dv. The "CALPUFF Modeling Report BART Applicability Screening Analysis" provided by Trinity Consultants is provided in Appendix B of LDEQ's 2017 Regional Haze SIP submittal.[50] The results of this screening modeling are summarized in the table below.

Table 3-2. Teche: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Caney Creek	0.106	0.064	0.099	0.106
Breton Island	0.243	0.179	0.299	0.299

Because the results of the modeling demonstrate that Teche Unit 3 has a visibility impact of less than 0.5 dv, we agree with the finding in the 2017 Louisiana Regional Haze SIP submittal that the unit is not subject to BART.

3. Entergy Sterlington Units 7AB and 7C

Entergy Louisiana LLC (Entergy) owns and operates the Sterlington Generating Plant (Sterlington) in Ouachita Parish, Louisiana. Sterlington is a fossil fueled steam and electric generation facility. Two units (7AB and 7C) were identified as BART-eligible emission units by LDEQ in their 2008 Regional Haze SIP submittal (2008 LA RH SIP).

[50] CALPUFF Modeling Report BART Applicability Screening Analysis: Cleco Corporation, Brame Energy Center, Teche Power Station, Prepared by Trinity Consultants, July 30, 2015.

Unit 7AB is a combined-cycle combustion turbine with a maximum heat input capacity of 923 million British thermal units/hr (MMBtu/hr) that primarily burns natural gas, and is equipped with a heat recovery steam generator (HRSG). The HRSG has a duct burner which uses natural gas as its primary fuel and has a heat input capacity of 221.6 MMBtu/hr. Unit 7C is a combined cycle combustion turbine with a maximum heat input capacity of 923 MMBtu/hr that primarily burns natural gas as its primary fuel and has a heat input capacity of 221.6 MMBtu/hr. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity Consultants conducted CALPUFF modeling on behalf of Entergy to determine if the visibility impacts from Sterlington exceeded the BART threshold of 0.5 dv. The "Entergy Louisiana, LLC, Sterlington Generating Plant, CALPUFF Modeling Report Initial BART Applicability Screening Analysis" provided by Trinity Consultants is provided in Appendix D of LDEQ's 2017 Regional Haze SIP submittal.[51] The results of this screening modeling are summarized in the table below.

Table 3-3. Sterlington: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Caney Creek	0.094	0.066	0.113	0.113
Breton Island	0.065	0.036	0.043	0.065

Because the results of the modeling demonstrate that Sterlington units 7AB and 7C have a visibility impact of less than 0.5 dv, we agree with the finding in the 2017 Louisiana Regional Haze SIP submittal that the units are not subject to BART.

4. NRG Big Cajun I

Louisiana Generating, LLC a subsidiary of NRG Energy owns and operates the Big Cajun I facility in Jarreau, Pointe Coupee Parish, Louisiana. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, CB&I conducted CALPUFF modeling on behalf of NRG to determine if the visibility impacts from Big Cajun I exceeded the BART threshold of 0.5 dv. The "Source-Specific Refined Screening assessment for BART-eligible Sources for Big Cajun I Facility" provided by CB&I is provided in Appendix C of LDEQ's 2017 Regional Haze SIP submittal.[52] The results of this screening modeling are summarized in the table below.

Table 3-4. Big Cajun I: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Caney Creek	0.069	0.046	0.056	0.069

[51] Entergy Louisiana, LLC, Sterlington Generating Plant, CALPUFF Modeling Report Initial BART Applicability Screening Analysis, Prepared by Trinity Consultants, August 31, 2015.
[52] Source-Specific Refined Screening assessment for BART-eligible Sources for Big Cajun I Facility, Prepared by CB&I, July 29, 2015.

Breton Island	0.120	0.097	0.139	0.139

Because the results of the modeling demonstrate that Big Cajun I units 1 and 2 have a visibility impact of less than 0.5 dv, we agree with the finding in the 2017 Louisiana Regional Haze SIP submittal that the units are not subject to BART.

5. NRG Big Cajun II

Louisiana Generating, LLC a subsidiary of NRG Energy owns and operates the Big Cajun II facility in New Roads, Pointe Coupee Parish, Louisiana. Unit 1 and Unit 2 were identified as BART-eligible. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, CB&I conducted initial CALPUFF modeling on behalf of NRG to determine if the visibility impacts from Big Cajun II exceeded the BART threshold of 0.5 dv. The "Source-Specific Refined Screening assessment for BART-eligible Sources for Big Cajun II Facility" provided by CB&I is provided in Appendix C of LDEQ's 2017 Regional Haze SIP submittal.[53] The results of this initial screening modeling utilizing the maximum 24-hr emissions rates from the 2000-2004 baseline period are summarized in the table below.

Table 3-5. Big Cajun II: 98th Percentile of daily maximum baseline (2000 -2004) visibility impact

Class I area	2001	2002	2003	Maximum
Caney Creek	0.927	0.781	1.048	1.048
Breton Island	1.897	2.166	1.486	2.166

As discussed in the 2017 Louisiana Regional Haze SIP revision, on March 6, 2013, Louisiana Generating entered a consent decree (CD) with EPA, the LDEQ, and others to resolve a complaint filed against Louisiana Generating for several violations of the CAA at Big Cajun II. *U.S. et al v. Louisiana Generating, LLC*, Civil Action No. 09-100-JJB-RLB (M.D. La.). Among other things, the CD requires Louisiana Generating to refuel Big Cajun II Unit 2 to natural gas, and install and continuously operate dry sorbent injection (DSI) at Big Cajun II Unit 1 while maintaining a 30-day rolling average emission rate of no greater than 0.380 lb/MMBtu by no later than April 15, 2015.[54] Prior to the submittal of the 2017 Regional Haze SIP, the LDEQ and Louisiana Generating entered into an Agreed Order on Consent (AOC) that made these existing control requirements and maximum daily emission limits permanent and enforceable for BART. The AOC is included in Louisiana's 2017 Regional Haze SIP revision. Thus, if the EPA finalizes its proposed approval of this portion of the SIP submittal, the control requirements and emission limits will become permanent and federally enforceable for

[53] Source-Specific Refined Screening assessment for BART-eligible Sources for Big Cajun II Facility, Prepared by CB&I, July 28, 2015.
[54] CD paragraph 62 in the docket for this rulemaking.

purposes of regional haze. As these controls were not installed to meet BART requirements, and existing enforceable emission limits for Units 1 and 2 prevent the source from emitting at levels seen during the 2000-2004 baseline, LDEQ's screening modeling in the 2017 Regional Haze SIP submittal utilizes the current daily emission limits for these units in the AOC as representative of the anticipated 24-hr maximum emissions for screening modeling purposes. Revised CALPUFF screening modeling prepared by CB&I utilizing these emission limits is summarized below and demonstrate that the source has an impact less than the 0.5 dv threshold.[55]

It should be noted that in addition to requiring DSI, the applicable enforcement CD requires Louisiana Generating to retire, refuel, repower, or retrofit Big Cajun II Unit 1 by no later than April 1, 2025. Louisiana Generating must notify us of which option it will select to comply with this condition no later than December 31, 2022.[56]

Table 3-6. Big Cajun II: Modeled emission rates

Facility/ Unit	**NOx (lbs/hr)**	**SO_2 (lbs/hr)**	**SO_4 (lbs/hr)**	**PM coarse (lbs/hr)**	**PM fine (lbs/hr)**	**EC (lbs/hr)**	**SOA (lbs/hr)**
Big Cajun II Unit 1	963.00	2439.60	0.00	109.2	83.4	3.09	0.97
Big Cajun II Unit 2	963.00	10.79	0.00	0.00	11.96	0.00	0.00

Table 3-7. Big Cajun II: 98th Percentile of daily maximum visibility impact, current emission limits.

Class I area	2001	2002	2003	Maximum
Caney Creek	0.239	0.179	0.282	0.282
Breton Island	0.449	0.488	0.361	0.488

Because the results of the revised screening modeling demonstrate that Big Cajun II units 1 and 2 have a visibility impact of less than 0.5 dv utilizing current emission limits, we agree with the finding in the 2017 Louisiana Regional Haze SIP submittal that the units are not subject to BART. We are proposing to approve the AOC which establishes enforceable emissions limits consistent with this revised screening analysis.

6. Cleco Brame Rodemacher and Nesbitt

Cleco Corporation (Cleco) owns and operates the Brame Energy Center in Lena, Rapides Parish, Louisiana. Brame Energy Center is a fossil fueled steam and electric generation facility. Two units Nesbitt I (Unit 1) and Rodemacher II (Unit 2) were identified as BART-eligible. Nesbitt I is a 440-MW boiler that primarily burns natural gas and is not equipped with any air pollution devices. Rodemacher II is a 523-MW wall-fired boiler

[55] Revised Baseline Modeling for Big Cajun II for BART Analysis, Prepared by CB&I, July 13, 2016. Available in Appendix C of the 2017 Louisiana Regional Haze SIP submittal
[56] CD paragraph 63 in the docket for this rulemaking.

that burns Powder River Basin (PRB) coal. It is currently equipped with Low-NOx Burners, Selective Non-Catalytic Reduction, and Dry Sorbent Injection. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity Consultants conducted CALPUFF modeling on behalf of Cleco to determine if the visibility impacts from Brame Energy Center exceeded the BART threshold of 0.5 dv. The "CALPUFF Modeling Report BART Applicability Screening Analysis" provided by Trinity Consultants is provided in Appendix B of LDEQ's 2017 Regional Haze SIP submittal.[57] The results of this CALPUFF screening modeling are summarized in the table below.

Table 3-8. Brame Energy Center: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Caney Creek	1.170	1.045	1.215	1.215
Breton Island	1.060	0.474	1.044	1.060

Because the results of the modeling demonstrate that Brame Energy Center has a visibility impact greater than 0.5 dv, we agree with the finding in the 2017 Regional Haze SIP submittal the units are subject to BART and must undergo a five-factor analysis. We note that the estimated sulfuric acid emissions for Rodemacher II in the screening modeling include removal of SO_3 in the form of ammonia bisulfate due to ammonia slip from the SNCR. Because the SNCR was not in operation during the 2000-2004 baseline period, the sulfuric acid emissions modeled for the baseline screening should have been higher. This would result in 2000-2004 baseline visibility impacts greater than those modeled by Trinity. Additional CALPUFF modeling performed by Trinity as part of the BART five factor analysis shows that modeled impacts from Rodemacher II alone exceeds the 0.5 dv threshold, even when considering more recent emissions based on current operation of DSI.[58] We also note that Cleco also had CAMx modeling performed as an additional screening analysis. However, this modeling was not conducted in accordance with the BART guidelines and we consider the CAMx modeling provided by Cleco to be invalid for supporting any determination of minimal visibility impacts. We discuss this CAMx modeling and the results of our own CAMx modeling for this source in more detail in the CAMx Modeling TSD.

7. Entergy Little Gypsy

Entergy operates three BART-eligible units at Little Gypsy Generating Plant (Little Gypsy). Unit 2 is an EGU boiler with a maximum heat input capacity of 4,550 MMBtu/hr that is permitted to burn natural gas as its primary fuel, and No. 2 and No. 4 fuel oil as

[57] CALPUFF Modeling Report BART Applicability Screening Analysis: Cleco Corporation, Brame Energy Center, Teche Power Station, Prepared by Trinity Consultants, July 30, 2015. Available in Appendix B of the 2017 Louisiana Regional Haze SIP submittal

[58] Impacts for DSI and FF control scenario are 0.521 dv at Breton and 0.589 dv at Caney Creek. See Table 5-5, CLECO Brame Energy Center BART Five-Factor Analysis, prepared by Trinity Consultants, October 31, 2015. Available in Appendix B of the 2017 2017 Louisiana Regional Haze SIP submittal.

secondary fuels. Unit 3 is an EGU boiler with a maximum heat input capacity of 5,578 MMBtu/hr that burns natural gas, but is also permitted to burn fuel oil. The auxiliary boiler for Unit 3 has a maximum heat input capacity of 252 MMBtu/hr and is permitted to burn only natural gas. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity conducted CALPUFF modeling on behalf of Entergy to determine if the visibility impacts from Little Gypsy exceeded the BART threshold of 0.5 dv. The "Updated BART Applicability Screening Analysis" provided by Trinity is provided in Appendix D of LDEQ's 2017 Regional Haze SIP submittal.[59] The results of this CALPUFF screening modeling are summarized in the table below.

Table 3-9. Little Gypsy: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Breton Island	1.294	1.402	1.954	1.954

Because the results of the modeling demonstrate that Entergy Little Gypsy has a visibility impact greater than 0.5 dv, we agree with the finding in the 2017 Regional Haze SIP submittal the units are subject to BART. We note that Entergy also had CAMx modeling performed as an additional screening analysis. However, this modeling was not conducted in accordance with the BART guidelines and we consider the CAMx modeling provided by Entergy to be invalid for supporting any determination of minimal visibility impacts. We discuss this CAMx modeling in more detail in the CAMx Modeling TSD.

8. Entergy Ninemile Point

Entergy operates two BART-eligible units at Ninemile Point Electric Generating Plant (Ninemile Point). Unit 4 is an EGU boiler with a maximum heat input capacity of 7,146 MMBtu/hr that burns primarily natural gas and No. 2 and No. 4 fuel oil. Unit 5 is an EGU boiler with a maximum heat input capacity of 7,152 MMBtu/hr that burns primarily natural gas and No. 2 and No. 4 fuel oil. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity conducted CALPUFF modeling on behalf of Entergy to determine if the visibility impacts from Ninemile Point exceeded the BART threshold of 0.5 dv. The "Updated BART Applicability Screening Analysis" provided by Trinity is provided in Appendix D of LDEQ's 2017 Regional Haze SIP submittal.[60] The results of this CALPUFF screening modeling are summarized in the table below.

Table 3-10. Ninemile Point: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Breton Island	2.518	2.393	3.348	3.348

[59] See Appendix J of the Updated BART Applicability Screening Analysis Prepared by Trinity Consultants, November 9, 2015.
[60] See Appendix E of the Updated BART Applicability Screening Analysis Prepared by Trinity Consultants, November 9, 2015.

Because the results of the screening modeling demonstrate that Entergy Ninemile Point has a visibility impact greater than 0.5 dv, we agree with the finding in the 2017 Regional Haze SIP submittal the units are subject to BART. We note that Entergy also had CAMx modeling performed as an additional screening analysis. However, this modeling was not conducted in accordance with the BART guidelines and we consider the CAMx modeling provided by Entergy to be invalid for supporting any determination of minimal visibility impacts. We discuss this CAMx modeling in more detail in the CAMx Modeling TSD.

9. Entergy Willow Glen

Entergy operates five BART-eligible units at the Willow Glen Electric Generating Plant (Willow Glen) in Iberville Parish, Louisiana. Unit 2 is an EGU boiler with a maximum heat input capacity of 2,188 MMBtu/hr that burns natural gas. Unit 2 is permitted to burn fuel oil, but has not done so in several years, and has no current operational plans to burn oil at this unit in the future. Unit 3 is an EGU boiler with a maximum heat input capacity of 5,900 MMBtu/hr that burns natural gas. Unit 3 is permitted to burn fuel oil, but has not done so in several years and Entergy has no operational plans to burn oil at this unit in the future. Unit 4 is an EGU boiler with a maximum heat input capacity of 5,400 MMBtu/hr that burns natural gas. Unit 4 is permitted to burn fuel oil, but it has not done so in several years and Entergy has no current operational plans to burn oil at this unit in the future. Unit 5 is an EGU boiler with a maximum heat input capacity of 5,544 MMBtu/hr that burns natural gas. Unit 5 is permitted to burn fuel oil, but has not done so in several years, and Entergy has no operational plans to burn oil at this unit in the future. The auxiliary boiler (206 MMBtu/hr) for Unit 3 burns natural gas. The auxiliary boiler is permitted to burn fuel oil, but it has not done so in several years, and Entergy has no operational plans to burn oil at this unit in the future.[61] Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity conducted CALPUFF modeling on behalf of Entergy to determine if the visibility impacts from Willow Glen exceeded the BART threshold of 0.5 dv. The "Updated BART Applicability Screening Analysis" provided by Trinity is provided in Appendix D of LDEQ's 2017 Regional Haze SIP submittal.[62] The results of this CALPUFF screening modeling are summarized in the table below.

Table 3-11. Willow Glen: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum

[61] As explained in the proposed rulemaking associated with this TSD, if any of the five units at Willow Glen decides to burn fuel oil, Entergy will complete a BART analysis for each pollutant for the fuel oil firing scenario and submit the analysis to the State. Upon receiving Entergy's submission indicating that the units intend to switch to fuel oil, the State will submit a SIP revision with BART determinations for the fuel oil firing scenario for the units intending to switch to fuel oil. The sources will not begin to burn fuel oil until we have approved the submitted SIP revision containing the BART determinations.

[62] See Appendix G of the Updated BART Applicability Screening Analysis Prepared by Trinity Consultants, November 9, 2015.

Breton Island	1.603	1.818	2.169	2.169

Because the results of the screening modeling demonstrate that Entergy Willow Glen has a visibility impact greater than 0.5 dv, we agree with the finding in the 2017 Regional Haze SIP submittal the units are subject to BART. We note that Entergy also had CAMx modeling performed as an additional screening analysis. However, this modeling was not conducted in accordance with the BART guidelines and we consider the CAMx modeling provided by Entergy to be invalid for supporting any determination of minimal visibility impacts. We discuss this CAMx modeling in more detail in the CAMx Modeling TSD.

10. Entergy Waterford

Entergy operates three BART-eligible units at the Waterford 1 & 2 Generating Plant (Waterford) in St. Charles Parish, Louisiana. Unit 1 is an EGU boiler with a maximum heat input capacity of 4,440 MMBtu/hr that burns primarily natural gas and No. 6 fuel oil as its secondary fuel. Unit 2 is an EGU boiler with a maximum heat input capacity of 4,440 MMBtu/hr that burns primarily natural gas and No. 6 fuel oil as its secondary fuel. Unit 3 auxiliary boiler (77 MMBtu/hr) burns only natural gas. Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity conducted CALPUFF modeling on behalf of Entergy to determine if the visibility impacts from Waterford exceeded the BART threshold of 0.5 dv. The "Updated BART Applicability Screening Analysis" provided by Trinity is provided in Appendix D of LDEQ's 2017 Regional Haze SIP submittal.[63] The results of this screening modeling are summarized in the table below.

Table 3-12. Waterford: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Breton Island	3.087	3.485	3.966	3.966

Because the results of the modeling demonstrate that Entergy Waterford has a visibility impact greater than 0.5 dv, we agree with the finding in the 2017 Regional Haze SIP submittal the units are subject to BART. We note that Entergy also had CAMx modeling performed as an additional screening analysis. However, this modeling was not conducted in accordance with the BART guidelines and we consider the CAMx modeling provided by Entergy to be invalid for supporting any determination of minimal visibility impacts. We discuss this CAMx modeling in more detail in the CAMx Modeling TSD.

[63] See Appendix F of the Updated BART Applicability Screening Analysis Prepared by Trinity Consultants, November 9, 2015.

As discussed later in this document in section IV.D where we discuss the control scenario CALPUFF modeling performed for Waterford, we discovered errors in the estimates of PM emissions. We remodeled the baseline impacts, correcting for this error.[64] Our visibility impact modeling results are summarized below.

Table 3-13. Waterford: 98th Percentile of daily maximum baseline visibility impact (EPA modeling)

Class I area	2001	2002	2003	Maximum
Breton Island	3.319	4.363	4.591	4.591

11. Entergy Nelson

Entergy operates three BART-eligible units at the Roy S. Nelson Electric Generating Plant. Unit 4 is an EGU boiler with a heat input capacity of 5,400 MMBtu/hr that burns primarily natural gas and is equipped with flue gas recirculation equipment installed for control of NOX emissions. Unit 6 is an EGU boiler with a heat input capacity of 6,216 MMBtu/hr that burns primarily coal and is equipped with Electrostatic precipitator (ESP) with flue gas conditioning for PM control and Separated Overfire Air (SOFA) Technology and a Low NOX Concentric Firing System (LNCFS) for NOX control. Auxiliary boiler (206 MMBtu/hr) for Unit 4 burns natural gas and fuel oil.

Pursuant to a Section 114 CAA Information Request issued by EPA Region 6, Trinity Consultants conducted CALPUFF modeling on behalf of Entergy to determine if the visibility impacts from Nelson exceeded the BART threshold of 0.5 dv. The "Updated BART Applicability Screening Analysis" provided by Trinity Consultants is provided in Appendix D of LDEQ's 2017 Regional Haze SIP submittal.[65] The results of this screening modeling are summarized in the table below.

Table 3-14. Nelson: 98th Percentile of daily maximum baseline visibility impact

Class I area	2001	2002	2003	Maximum
Caney Creek	0.743	0.679	0.748	0.748
Breton Island	0.65	0.396	0.798	0.798

Because the results of the modeling demonstrate that Entergy Nelson has a visibility impact greater than 0.5 dv, we agree with the finding in the 2017 Regional Haze SIP submittal the units are subject to BART. We note that Entergy also had CAMx modeling performed as an additional screening analysis. However, this modeling was not conducted in accordance with the BART guidelines and we consider the CAMx modeling

[64] We also utilized a larger CALPUFF modeling domain to address concerns that the source plume was being transported out of the modeling grid and estimates of impacts and benefits of controls might be underestimated with the smaller grid.

provided by Entergy to be invalid for supporting any determination of minimal visibility impacts. We discuss this CAMx modeling and the results of our own CAMx modeling for this source in more detail in the CAMx Modeling TSD. We also note that additional CALPUFF modeling provided by Trinity Consultants using 2012-2014 emissions also showed visibility impacts over the 0.5 dv threshold at Breton.

As discussed later in this document in Section IV.E where we discuss the control scenario modeling performed for Nelson unit 6, we discovered errors in the estimates of sulfuric acid emissions. We remodeled the baseline impacts, correcting for this error.[66] Our visibility impact modeling results are summarized below.

Table 3-15. Nelson: 98th Percentile of daily maximum 2000-2004 baseline visibility impact (EPA modeling)

Class I area	2001	2002	2003	Maximum
Caney Creek	1.251	0.99	1.225	1.251
Breton Island	1.022	0.471	1.189	1.189

D. Summary of CALPUFF BART Screening

With the use of CALPUFF modeling results as discussed above, Louisiana concluded, and we are proposing to agree, that the facilities listed in Table 3-16 have visibility impacts greater than 0.5 dv. These facilities are therefore subject to BART and must undergo a five-factor analysis.

Table 3-16. Subject to BART Sources

Facility Name	Units	Parish
Cleco Rodemacher/Brame	Nesbitt I (Unit 1) Rodemacher II (Unit 2)	Rapides
Entergy Waterford	Units 1, 2, and auxiliary boiler	St. Charles
Entergy Willow Glen	Units 2, 3, 4, 5, and auxiliary boiler	Iberville
Entergy Ninemile Point	Units 4 and 5	Jefferson
Entergy Little Gypsy	Units 2 and 3 and auxiliary boiler	St. Charles
Entergy R.S. Nelson	Units 4 and 6 and auxiliary boiler	Calcasieu

We note that we performed additional modeling using CAMx to evaluate the visibility impacts and benefits of controls for the Nelson, Cleco Rodemacher, and Big Cajun II sources to address possible concerns with utilizing CALPUFF to assess visibility impacts at Class I areas located far from this large emission source. See the CAMx Modeling TSD for additional information and results.

IV. CALPUFF modeling for BART five factor analysis

For those units determined to be subject-to-BART, an analysis of BART must be performed. The BART analysis for those units determined to be subject-to-BART includes engineering and modeling methods and procedures used to determine the appropriate controls for the subject-to-BART units to reduce the source's contribution to pollutant concentrations that result in visibility impairment in the surrounding Class I areas. The final factor to consider under EPA's BART Guidelines is the degree of visibility improvement from the BART control options.[67] The BART guidelines again recommend use of the CALPUFF air quality dispersion model to estimate the visibility improvements at each Class I area, and to compare these to each other and to the impact of the baseline, or current, source configuration.

A. Cleco Brame Rodemacher and Nesbitt

For Rodemacher II, visibility benefits of wet flue gas desulfurization (WFGD), dry flue gas desulfurization (DFGD), enhanced dry sorbent injection (DSI), and DSI were evaluated and compared to the baseline visibility impacts following the CALPUFF protocol discussed above.[68] NOx emissions were held constant at the baseline rate for all control scenarios modeled. SO2 emissions modeled were based on assumed emission rates of 0.41 lb/MMBtu for DSI, 0.30 lb/MMBtu for enhanced DSI, 0.06 lb/MMBtu for DFGD, and 0.04 lb/MMBtu for WFGD. The table below summarizes the model results for these control scenarios.

Table 4-1. Anticipated visibility benefit due to controls on Cleco Rodemacher Unit 2 (CALPUFF, 98th percentile)

		Visibility benefit of controls over baseline (dv)			
Class I area	Baseline Impact (dv)	DSI[69]	Enhanced DSI	SDA	WFGD
Breton	0.724	0.134	0.226	0.436	0.445
Caney Creek	0.734	0.085	0.122	0.311	0.322

[67] 59 FR 39104, 39170 (July 6, 2005).
[68] CLECO Brame Energy Center BART Five-Factor Analysis, prepared by Trinity Consultants, October 31, 2015 revised on April 14, 2016 and April 18, 2016. Available in Appendix B of the 2017 Louisiana Regional Haze SIP.
[69] DSI modeled at 0.41 lb/MMBtu, DSI and fabric filter are already installed and operational.

Enhanced DSI achieves benefits of approximately 0.092 dv at Breton and 0.037 dv at Caney Creek Wilderness (Caney Creek) over DSI and benefits of 0.226 dv at Breton and 0.122 dv at Caney Creek over the baseline impairment. The visibility benefits of SDA and wet FGD exceed the benefits from enhanced DSI by approximately 0.2 dv at Caney Creek and Breton. We performed additional modeling using CAMx to evaluate the visibility impacts and benefits of controls for this unit to address possible concerns with utilizing CALPUFF to assess visibility impacts at Class I areas located far from this large emission source. See the CAMx Modeling TSD for additional information and results.

For Nesbitt I, the BART determination is based on the use of natural gas only and an emission limit for SO2 of 3.0 lb/hr.[70] Therefore, no modeling evaluation of benefits of additional SO2 controls needed to be performed.

B. Entergy Little Gypsy and Entergy Ninemile Point

LDEQ and Entergy entered into an AOC limiting fuel oil to ULSD with a sulfur content of 0.0015% for Little Gypsy Units 2 and 3 and Ninemile Point Units 4 and 5. As the BART Guidelines state "if a source commits to a BART determination that consists of the most stringent controls available, then there is no need to complete the remaining analyses."[71] Entergy states that during the baseline period, Little Gypsy Units 2 and 3 burned fuel oil[72] with an average sulfur content of 0.5% and Ninemile Point units 4 and 5 burned fuel oil with an average sulfur content of 0.3%. Switching to ULSD will result in a reduction of SO_2 emissions of over 99%. We propose to find that ULSD is the most stringent control available for addressing SO_2 emissions from fuel oil burning. Thus no modeling evaluation of benefits of additional SO2 controls is needed.

We note that visibility benefits of switching to a lower sulfur fuel oil, ULSD at 0.0015% S was modeled using the CALPUFF protocol reviewed above for both Little Gypsy and Ninemile Point.[73],[74] These visibility benefit analyses are available in Appendix D of the 2017 Louisiana Regional Haze SIP.

Visibility benefits of add-on PM controls were also evaluated. CALPUFF modeling was performed for control scenarios including fuel switching to ULSD, cyclone (40% reduction in PM emissions), wet scrubber (55%), and wet ESP (90%). NOx emissions were held constant at the baseline rate for all control scenarios modeled. SO2 emissions were also held constant except for the fuel switching scenario. The modeled visibility benefits of add-on controls are very small and range from 0.0 dv to 0.08 dv for each unit

[70] See AOC in Appendix B of the 2017 Louisiana Regional Haze SIP submittal.
[71] See 40 C.F.R. Part 51, Appendix Y, IV, D
[72] The primary fuel burned has historically been pipeline quality natural gas.
[73] Entergy Louisiana, LLC, Little Gypsy Generating Plant, BART Five-Factor Analysis, Prepared by Trinity Consultants, November 9, 2015, Revised April 14, 2016. Available in appendix D of the LA RH SIP.
[74] Entergy Louisiana, LLC, Ninemile Point Generating Plant, BART Five-Factor Analysis, Prepared by Trinity Consultants, November 9, 2015, revised April 14, 2016. Available in appendix D of the LA RH SIP.

for cyclone, wet scrubber, and wet ESP. See the visibility benefit analyses available in Appendix D of the 2017 Louisiana Regional Haze SIP for more information.

For Little Gypsy auxiliary boiler that is subject to BART, this unit only burns natural gas. Thus, no modeling evaluation of benefits of additional SO2 or PM controls was needed.

C. Entergy Willow Glen

Entergy Willow Glen considered two firing scenarios, natural gas firing and fuel oil firing for the subject to BART units. For natural gas firing, no modeling evaluation of benefits of additional SO2 or PM controls was needed. Louisiana has committed to submit a SIP revision with a BART five factor analysis for fuel oil firing should the facility decided to burn fuel oil in the future.

D. Entergy Waterford

Waterford Units 1 and 2 burn natural gas and fuel oil. The sulfur content of the fuel oil burned during the baseline period was 1.0%. Visibility benefits of switching to a lower sulfur fuel oil, 0.5% S No. 6 fuel oil was modeled using the CALPUFF protocol reviewed above.[75] NOx emissions were held constant at the baseline rate for all control scenarios modeled. Modeled PM emissions were based on stack test data from one day. The table below summarizes the results.

Table 4-2. Waterford Unit 1: Visibility Benefits of Fuel Switching (dv, 98th percentile)

Class I area	Baseline Impact (dv)	Visibility Impact with 0.5% S	Visibility benefit of 0.5% S
Breton	2.263	1.591	0.672

Table 4-3. Waterford Unit 2: Visibility Benefits of Fuel Switching (dv, 98th percentile)

Class I area	Baseline Impact (dv)	Visibility Impact with 0.5% S	Visibility benefit of 0.5% S
Breton	2.054	1.509	0.545

The BART analysis included in the 2017 SIP submission provided no discussion or demonstration that the identified and modeled PM emission rate based on stack test data is representative of maximum actual emissions. In addition, in assessing the visibility

[75] Entergy Louisiana, LLC, Little Gypsy Generating Plant, BART Five-Factor Analysis, Prepared by Trinity Consultants, November 9, 2015. Available in appendix D of the LA RH SIP.

benefits of fuel switching, Louisiana submitted CALPUFF modeling for only 1% sulfur and 0.5% sulfur fuel oil. We believe the units could be modified to burn distillate fuel oils, with even lower sulfur content, at low cost. Therefore, in addition to our consideration of 0.5% No. 6 fuel oil, we also considered No. 2 fuel oils with 0.3% sulfur and ultra-low sulfur diesel, which has a sulfur content of 0.0015%. We performed additional CALPUFF modeling to adjust the PM emissions used in modeling and to evaluate the visibility benefits of additional fuel types (0.0015% and 0.3% sulfur fuel oils). PM and SO2 emission rates for control cases were based on AP-42 factors and the maximum heat input for each unit.[76] Table 4-4 below summarizes the results of that modeling.[77] See Appendix A for emission inputs used.

Table 4-4. Waterford: Visibility Benefits of Fuel Switching (dv, 98th percentile, EPA modeling)

	Class I area	Baseline Impact (dv)	Visibility benefit 0.5% S	Visibility benefit of 0.3% S	Visibility benefit of 0.0015% S
Unit 1	Breton	2.704	0.883	1.348	1.744
Unit 2	Breton	2.378	0.798	1.207	1.601

Visibility benefits of PM controls were also evaluated.[78] CALPUFF modeling was performed for control scenarios including, cyclone (40% reduction in PM emissions), fuel switching to 0.5% S fuel oil (50%), wet scrubber (55%), and wet ESP (90%). NOx emissions were held constant at the baseline rate for all control scenarios modeled. SO2 emissions were also held constant with the exception of the fuel switching scenario. The modeled benefits are summarized below (fuel switching benefits are summarized in the table above).

Table 4-5. Waterford Unit 1: Visibility Benefits of PM controls (dv, 98th percentile)

Class I area	Baseline Impact (dv)	Visibility benefit of controls over baseline (dv)		
		Cyclone	Wet Scrubber	Wet ESP
Breton	2.263	-0.002	-0.013	0.028

Table 4-6. Waterford Unit 2: Visibility Benefits of PM controls (dv)

Class I area	Baseline Impact (dv)	Visibility benefit of controls over baseline (dv)		
		Cyclone	Wet Scrubber	Wet ESP
Breton	2.054	-0.004	-0.028	0.060

[76] See "Waterford CALPUFF inputs and monthly ei and 767 data.xlsx" for emission inputs and calculations.
[77] See " LA_CALPOST_Waterford.xlsx" for additional model results.
[78] Entergy Louisiana, LLC, Little Gypsy Generating Plant, BART Five-Factor Analysis, Prepared by Trinity Consultants, November 9, 2015 revised April 14, 2016. Available in appendix D of the LA RH SIP.

For the Waterford auxiliary boiler that is subject to BART, this unit only burns natural gas. Thus, no modeling evaluation of benefits of additional SO2 or PM controls was needed.

E. Entergy Nelson

For Entergy Nelson Unit 6, visibility benefits of WFGD, DFGD, enhanced DSI, DSI, and lower sulfur coal were evaluated and compared to the revised baseline visibility impacts (using 2012-2014 emissions) following the CALPUFF protocol discussed above.[79] NOx emissions were held constant at the rate identified from the 2012-2014 period for all control scenarios modeled. SO2 emissions modeled were based on assumed emission rates of 0.6 lb/MMBtu for lower sulfur coal, 0.47 lb/MMBtu for DSI, 0.19 lb/MMBtu for enhanced DSI, 0.06 lb/MMBtu for DFGD, and 0.04 lb/MMBtu for WFGD. We note that the baseline emission rates are based on 24-hr actual emissions during the baseline periods while the control scenario emission rates are based on anticipated 30-day boiler operating day rolling emission rates. At a maximum heat input of 6126 MMBtu/hr for the boiler, the baseline short term emission rates are approximately 1.2 lb/MMbtu for the 2000-2004 baseline and 1.0 lb/MMBtu for Entergy's alternative 2012-2014 baseline. The table below summarizes the model results prepared by Trinity Consultants for Entergy Nelson and included in the 2017 Louisiana Regional Haze SIP submittal for these control scenarios.

Table 4-7. Visibility Impact and benefits of controls, Nelson Unit 6.

Class I area	"Refined Baseline" Impact (dv)[1]	Visibility benefit of controls over refined baseline (dv)				
		Lower sulfur coal	DSI	Enhanced DSI	DFGD	WFGD
Breton	0.493	0.157	0.384	0.333	0.391	0.399
Caney Creek	0.463	0.164	0.302	0.304	0.355	0.365

[1] "Refined baseline" impacts based on 2012-2014 emissions.

We identified errors in the calculation of emissions modeled for RS Nelson unit 6 for the baseline and control scenarios. The calculation of sulfuric acid emissions using the EPRI method contained errors in the input of uncontrolled emissions and the application of factors to account for removal of sulfuric acid by downstream equipment. Estimates developed by Trinity Consultants for Entergy Nelson utilized the controlled SO2 emission rate rather than the uncontrolled rate when estimating the amount of sulfuric acid generated during combustion. The input for sulfur dioxide emissions (E2) must be

[79] Entergy Services, Roy S. Nelson Generating Plant, BART Five-Factor Analysis, Prepared by Trinity Consultants, November 9, 2015, revised April 15, 2016. Available in Appendix D of the 2017 LA Regional Haze SIP.

the uncontrolled SO2 emissions rate rather than a controlled rate based on removal equipment. As explained in the EPRI report:

> When any source uses FGD equipment or another technology to control SO2 emissions, either the fuel basis must be used for the manufacturing and release calculations, or CEMS data can be used, but only when the CEMS precedes the FGD or SO2 control equipment. Data from a CEMS located after a flue gas desulfurization system cannot be used, because the measured SO2 has already been decreased by the control equipment, and therefore is not an accurate predictor of the SO3 emissions rate.

In addition, Trinity's estimates noted that the flue gas conditioning was moved to be downstream of the air preheater, however this was not reflected in the control scenario estimates. The anticipated removal of sulfuric acid in the air preheater should not be applied to the amount of sulfuric acid introduced by flue gas conditioning because the flue gas conditioning now occurs after the preheater. We also noted an error in the application of technology impact factors ($F2_x$) that describe sulfate removal observed over the air heater, the ESP or other particulate control device, and FGD process equipment. All of the factors that apply must be multiplied together to estimate the removal of a combination of downstream equipment. Estimates developed by Trinity Consultants for Entergy Nelson summed these factors rather than multiplying them, resulting in a failure to properly account for the anticipated removal of sulfuric acid. We have corrected for these errors and recalculated the sulfuric acid emissions for each modeled scenario. [80] See Appendix B for a summary of emission inputs.

We also adjusted PM emissions for control scenarios that included a fabric filter to account for the increased removal of PM. PM10 emissions were reduced by 50% to estimate an anticipated additional removal of PM. While this is not a refined estimate of the additional PM reduction anticipated for the control scenarios, PM emissions are already reduced significantly due to the existing ESP (estimated 99.5% removal for PM filterable) and the visibility impact from direct PM emissions are a very small portion of the overall visibility impact due to the facilities emissions. Therefore, we do not anticipate a more refined approach to estimate PM emissions for these scenarios would significantly impact the modeling results.

Finally, we remodeled utilizing a larger modeling domain. In general, the approach Trinity utilized to establish the modeling domain (extending 50 km beyond the source and each class I area) seemed acceptable. However, our initial modeling demonstrated that the model results are sensitive to this assumption, and the use of a larger modeling domain resulted in higher impacts on certain days. This is due to the model's inability to track puffs that exit and then re-enter the modeling domain before impacting the Class I area. Using a larger modeling domain prevents puffs from being lost by exiting the domain.

[80] See "Nelson CALPUFF inputs.xlsx" for emission inputs and revised EPRI calculations.

The table below summarizes the CALPUFF model results prepared by EPA for Entergy Nelson.[81] We also provide modeled impact and benefits from the revised baseline developed by Entergy (using 2012-2014 emissions) to allow for direct comparison with Trinity's CALPUFF model results (See Table 4-9).

Table 4-8. Visibility Benefits of Controls on Nelson Unit 6 over baseline (98th percentile, EPA modeling)

Class I area	Baseline Impact (dv)	Visibility benefit of controls over baseline (dv)				
		Lower sulfur coal	DSI	Enhanced DSI	DFGD	WFGD
Breton	1.189	0.617	0.725	0.915	0.983	0.990
Caney Creek	1.251	0.668	0.756	0.958	1.035	1.035

Table 4-9. Visibility Benefits of Controls on Nelson Unit 6 over "refined baseline" (98th percentile, EPA modeling)

Class I area	"Refined Baseline" Impact (dv)[1]	Visibility benefit of controls over refined baseline (dv)				
		Lower sulfur coal	DSI	Enhanced DSI	DFGD	WFGD
Breton	0.865	0.295	0.401	0.612	0.678	0.691
Caney Creek	0.805	0.222	0.31	0.514	0.589	0.589

[1]"Refined baseline" impacts based on 2012-2014 emissions.

We performed additional modeling using CAMx to evaluate the visibility impacts and benefits of controls for this unit to address possible concerns with utilizing CALPUFF to assess visibility impacts at Class I areas located far from this large emission source. See the CAMx Modeling TSD for additional information and results.

[81] See "LA_CALPOST_Nelson.xlsx" for additional model results.

Note: Modeling files (CALPUFF and CAMx) are large and due to size and/or file type cannot be added to the electronic docket available at www.regulations.gov. Electronic files are available upon request. Contact Erik Snyder (Snyder.erik@epa.gov 214-665-7305) or Michael Feldman (Feldman.Michael@epa.gov 214-665-9793).

Appendix A. EPA CALPUFF Emission inputs for Waterford Units

Unit 1	SO2 (lb/hr)	NOX (lb/hr)	SO4 (lb/hr)	PMc (lb/hr)	PMf (lb/hr)	SOA (lb/hr)	EC (lb/hr)
base	5,274.50	3,087.17	55.90	104.50	260.00	9.90	20.80
0.50%	2,544.97	3,087.17	55.10	64.30	160.10	9.70	12.80
0.30%	1,479.74	3,087.17	25.80	22.90	56.90	4.60	4.50
0.0015%	7.40	3,087.17	39.60	19	46	7.00	3.70

Unit 2	SO2 (lb/hr)	NOX (lb/hr)	SO4 (lb/hr)	PMc (lb/hr)	PMf (lb/hr)	SOA (lb/hr)	EC (lb/hr)
base	4,532.75	2,718.58	47.80	89.30	222.30	8.40	17.80
0.50%	2,176.54	2,718.58	47.1	55	136.9	8.3	10.9
0.30%	1,265.52	2,718.58	22.1	19.5	48.6	3.9	3.9
0.0015%	6.33	2,718.58	33.8	15.8	39.3	6	3.1

Appendix B. EPA CALPUFF Emission inputs for Nelson (lb/hr)

Unit 6	SO2	SO4	NOx	PMc	PMf	EC	SOA
base	7443.5	14.564	5827.08	71.79	55.31	2.13	16.05
2012-2014 base	6178.42	26.011	1565.75	71.88	55.38	2.13	15.31
low sulfur	3729.6	24.164	1565.75	72.41	55.79	2.14	15.42
DSI w/ESP	2921.52	5.202	1565.75	16.62	16.01	0.62	105.38
Enhanced DSI	1181.04	0.520	1565.75	8.445	8.13	0.31	53.525
DFGD	372.96	0.361	1565.75	32.355	24.925	0.96	13.785
WFGD	248.64	10.405	1565.75	26.34	27.9	1.07	16.83

	SO2	SO4	NOx	PMc	PMf	EC	SOA
Unit 4	2.75	1.38	796.75			8.56	24.29
Auxiliary Boiler	106.76	0.63	56.55	0.74	1.83	0.15	0.11